

Phyllocladus hypophyllus Hook. f.

By HSUAN KENG

Department of Botany, University of Singapore

FROM JUNE to July in 1961, I joined an expedition to Gunong Mulu, Sarawak. During the trip, pickled and herbarium specimens of *Phyllocladus hypophyllus* Hook. f. were collected. As our present knowledge of this interesting species is still more or less limited to the incomplete descriptions prepared by Hooker f. in 1852 and by Pilger in 1903, a comprehensive description of the external morphology and a drawing both made from authentic specimens, are here presented. An anatomical study of the seedling, phylloclade, male and female strobili, and young seed of this species will be published elsewhere.*

Many specimens of this plant from various geographical regions, cited in this paper, are deposited in the herbarium of the Singapore Botanic Gardens. For the facilities provided, I am greatly indebted to Mr. H. M. Burkill, Director of the Gardens.

I wish to express my sincere gratitude to Professor H. B. Gilliland for his encouragement during the progress of this study and for reviewing the manuscript, and to Dr. J. A. R. Anderson, for his distinguished leadership during the expedition.

PHYLLOCLADUS HYPOPHYLLUS Hook. f., Icon. Pl. II, 5 (1852) t. 889; Walp. Ann. 5 (1858) 801; Carr. Conif. (1867) 706; Parl. in DC. Prodr. 16, 2 (1868) 499; Stapf. in Trans. Linn. Soc. Bot. 4 (1894) 249; Pilger, in Engl. Pflanzenreich IV, 5 (1903) 99; Ridl. in Journ. Soc. Str. Br. Roy. As. Soc. 63 (1912) 62; Gibbs in Journ. Linn. Soc. Bot. 42 (1914) 195, Contrib. Phytogeo. Fl. Arfak Mt. (1917) 82; Merr. in Journ. Soc. Str. Br. Roy. As. Soc. sp. no. (1921) 32, Enum. Philip. Fl. Pl. 1 (1925) 5; Dallim. & Jacks., Handb. Conif. 4th ed. (1948) 53.

Phyllocladus hypophyllus Hook f. var. *protracta* Warb. Monsun. I (1900) 194.

Phyllocladus protractus (Warb.) Pilger, in Engl. Pflanzenreich IV, 5 (1903) 99; Perk. Frag. Fl. Philip. (1904) 44; Foxw. ex Merr. in Philip. Journ. Sci. 2 (1907) Bot. 259, 6 (1911) Bot. 165, t. 31.

Shrub, small or large tree, up to 30 m. high or more; bark brownish to dark brown, flaky; juvenile leaves on seedlings linear, 0.5–0.8 cm. long; scale leaves on seedlings or on the branchlets and phylloclades of mature plants awl-shaped, 0.2–0.3 cm. long, scarious, deciduous; phylloclades on seedlings variable in shape and size, from spatulate to rhomboidal, 2–8 cm. long, 0.5–4 cm.

* H. Keng, Aspects of morphology of *Phyllocladus hypophyllus*. Ann. Bot. (n.s. Vol. 26 No. 104, 1962. in press).

wide, the apex acute or caudate, the base narrowly attenuate, the margins irregularly serrate, lacerate or pinnatifid; phylloclades on mature plants distichously and pinnately arranged on the lateral branchlets which are born verticillately or subverticillately on branches, each individual phylloclade oblanceolate, obovate to rhomboidal, 1.5–6 cm. long, 1–3 cm. wide, the upper surfaces shining, dark green, the lower surfaces often glaucous when young, becoming grey-purplish or dark and punctate later, the apex acuminate, obtuse or bilobed, the margins coarsely and irregularly serrate or crenate, usually entire and obliquely attenuate towards the base, the venation flabellate, the veins more or less radiating from the base of phylloclade, prominent on both surfaces; strobili unisexual, dioecious; male strobili yellowish brown, often 2–3 or more in clusters on the apices of dwarf branchlets, sometimes mixed with sterile phylloclades or phylloclades bearing reduced female strobili, each individual male strobilus cylindric, 0.8–1.2 cm. long, stalked, the microsporophylls triangular, scarious, with two rounded pollen-sacs, the pollen grains winged; female strobili purplish, solitary or rarely 2 (or 3) together situated in the notches of bilobed phylloclades or occasionally on the tips of reduced phylloclades, each individual female strobilus subglobular or ovoid, consisting of 15 or more coalescent scales, only 2 or 3 of these scales bearing a single erect ovule, generally only 1 ovule in each female strobilus developing into a seed; seeds chestnut brown, ovoid, 5–7 mm. long, flattened at front and back, the upper part protruding from a greyish, papery, cup-like arillus, and the basal part embedded in a fleshy, swollen, yellowish brown receptacle formed by the abortive scales of female strobilus; cotyledons two, linear lanceolate on seedlings, 2–2.5 cm. long, 2–3 mm. wide.

Specimens examined:

Sarawak:

Gunong Mulu, Alt. 1,300 m., path from Sg. Melinau Paku. Baram, *Anderson & Keng 4553*, July 2, 1961 (Tree, 1.1 m. girth, 20 m. high, in submontane forest, sterile); alt. 2,300 m., path to summit, *Anderson & Keng 4544*, July 2, 1961 (Small tree, 3.3 m. high, on exposed ridge near summit).

Brunei:

Lower Mossy forest, Bt. Ulak, alt. 1,400 m. *P. S. Ashton 1033*, no date (23 m. mature tree, bark dull purple, flaky and powdery, slightly dippled in places).

North Borneo:

Mile 39, Penampang-Sensuram, alt. 2,000 m. *Leano-Castro 5992*, July 1936 (26 m. high, 1.8 m. girth, non-resinous); Kumu Rengis, Jesselton, alt. 26 m. *J. W. Sow 71650*, June, 1952 (Rising ground, 15 m. tall, 1 m. girth, bh.).

Mt. Kinabalu: Pakka Cave, 3,400 m. *R. E. Holttum*, s.n., Nov. 1931, *J. & M. S. Clemens* 29328, March 1932, *C. E. Carr* 27632, June 1933, *J. Wyatt-Smith* 80371, Aug. 1954 (Shrub 2.3 m. tall); 3,300 m. *G. D. Haviland* 1092, 1892 (Shrub dioecious); below Sayat Sayat, alt. 3,800 m., *C. E. Carr* 27617, June 1933; below Kambarangan wireless station, alt. 2,320 m. *J. Sinclair* 9053, June 1957 (Common tree, leaves glossy green at both surfaces, dark above, paler beneath).

Indonesian Borneo:

Top of Mt. Semedoem, *H. Hallier* No. 697, 1893-94; Westerafd. v. Borneo, Bengkajang, Banan, alt. 1,200 m. *Neth. Ind. For. Serv. hb.* 24777, July 1938.

Celebes:

Celebes en Ond. Malili, alt. 1,300 m. *Neth. Ind. For. Serv. hb.* 19582, Apr. 1935.

Philippines:

Bauan, Mt. Tabuan, Cagayan Prov., Luzon, *M. Ramos* 77101. May 1929.

New Guinea:

Al River Mts., Nondugl, West Highlands, alt. 2,300 m. *J. S. Womersley* 5351, Sept. 7, 1953 (Tree 20 m. overall, in *Nothofagus* forest; wood pale to dark straw colour).

Nassau Geb. alt. 2,600 m., *W. M. Docters V. Leeuwen* 10906, Oct. 1926; Wissel Lake region, Tarapadimi, near bivouac, sec. vegetation, *P. J. Eyma* 5228, Sept. 1939; Mt. Digatara, *P. J. Eyma* 5371, Oct. 30, 1939; Tsland and Tage River, alt. 1,750 m., *P. J. Eyma* 4954, Sept. 1939.

This is the only species of *Phyllocladus* reaching the Malaysian region, the rest of 5 species of the genus are confined to New Zealand and Tasmania.

The type specimen of this species was collected by H. Low from Mt. Kinabalu, North Borneo. The plant subsequently found in the Philippines and New Guinea was described by Warburg as a variety, namely, var. *protracta*, of this species. This variety was raised to the specific rank by Pilger. Independently, Gibbs (1917) and Merrill (1925) pointed out that these two species are synonymous. Gibbs made the following notes: "I fail to distinguish any difference between the above species (*Phyllocladus hypophyllus* Hook. f.) and *P. protractus* Pilg. It is a very variable plant like other *Phyllocladus* spp., differing according to the age of the plant and whether the fertile branches occur on the old or the young wood. The series of variations obtained by me on Kinabalu are duplicated in the Arfak material and appear also marked in the large amount of material from the Philippines available at Kew for comparison."



Phyllocladus hypophyllus Hook. f.

1. A young seedling showing the cotyledons, juvenile leaves, scale leaves and phylloclades.
2. A seedling showing the incised and pinnatifid phylloclades.
3. A branch from a mature plant showing the verticillate branchlets bearing two rows of phylloclades.
4. A dwarf shoot bearing 3 young, male strobili.
5. A dwarf shoot bearing dried, male strobili and phylloclades with reduced female strobili.
6. A microsporophyll with two dehiscing pollen-sacs.
7. A winged pollen grain.
8. Portion of a branchlet showing the female strobili situated in the notches of bilobed phylloclades.
9. Portion of a branchlet showing the female strobili seated on the top of reduced phylloclades.
10. Seed with cuplike arillus embedded in swollen receptacle; the whole structure remaining in the notch of a bilobed phylloclade.